Remarks

A. Pending Claims

Claims 1691-1753 are pending. Claims 1748-1753 are new. Claims 1691, 1711, and 1731 have been amended. The new claims and the amendments to the existing claims are supported by Applicant's Specification at least at page 39, lines 4-15 and from page 53, line 12 to page 54, line 3. No new matter has been added.

B. Examiner Interview

Applicant's representative, Eric B. Meyertons, met with Examiner Paik on November 14, 2007. The inventions, claims, and cited art were discussed. Applicant's representative discussed the combinations of features in the claims, and presented reasons as to why such combinations of features were not taught in, or obvious in view of, the cited art. No agreement was reached, however the Examiner agreed to consider Applicant's statements, etc. Applicant respectfully thanks the Examiner for taking the time to discuss the case with Eric B. Meyertons.

C. The Claims Are Not Obvious Over Eastlund et al. In View of Rose Pursuant To 35 U.S.C. §103(a)

Claims 1691-1697, 1699-1717, and 1719-1747 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,716,960 to Eastlund et al. (hereinafter "Eastlund") in view of European Patent Application 0130671 to Rose (hereinafter "Rose"). Applicant respectfully disagrees with these rejections.

To reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011, 154 U.S.P.Q. 173, 177-178 (C.C.P.A. 1967). To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP § 2143.03.

Claim 1691 describe combinations of features including:

> a heater well extending from a surface of the earth through an overburden of the formation and into a hydrocarbon containing layer in the formation; ...
>
> at least one electrical conductor comprising one or more ferromagnetic sections, and being configured to provide an electrically resistive heat output during application of AC to the electrical conductor such that heat transfers from the electrical conductor to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.

Claim 1711 describe combinations of features including:

> a heater well extending from a surface of the earth through an overburden of the formation and into a hydrocarbon containing layer in the formation; ...
>
> at least one electrical conductor comprising one or more ferromagnetic sections, and being configured to provide an electrically resistive heat output during application of AC to the electrical conductor such that heat transfers from the electrical conductor to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.

Claim 1731 describes a combination of features including:

> providing AC at a voltage above about 200 volts to one or more electrical conductors located in a heater well extending from a surface of the earth through an overburden of the formation and into a hydrocarbon containing layer in the formation, ...
>
> allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.

Applicant submits that the cited art does not teach or suggest at least the above-quoted combinations of features in claims 1691, 1711, and 1731, and the claims dependent thereon.

The terms "overburden" and "hydrocarbon containing layer" disclosed in the claims are described in Applicant's Specification. For example, these terms are described in the following sections of Applicant's Specification:

> A "formation" includes one or more hydrocarbon containing layers, one or more non-hydrocarbon layers, an overburden, and/or an underburden. An "overburden" and/or an "underburden" includes one or more different types of impermeable materials. For example, overburden and/or underburden may

include rock, shale, mudstone, or wet/tight carbonate (i.e., an impermeable carbonate without hydrocarbons). In some embodiments of in situ conversion processes, an overburden and/or an underburden may include a hydrocarbon containing layer or hydrocarbon containing layers that are relatively impermeable and are not subjected to temperatures during in situ conversion processing that results in significant characteristic changes of the hydrocarbon containing layers of the overburden and/or underburden. For example, an underburden may contain shale or mudstone. In some cases, the overburden and/or underburden may be somewhat permeable. (page 39, lines 4-15);

Each hydrocarbon containing layer of a formation may have a potential formation fluid yield or richness. The richness of a hydrocarbon layer may vary in a hydrocarbon layer and between different hydrocarbon layers in a formation. Richness may depend on many factors including the conditions under which the hydrocarbon containing layer was formed, an amount of hydrocarbons in the layer, and/or a composition of hydrocarbons in the layer. Richness of a hydrocarbon layer may be estimated in various ways. (page 53, lines 12-17); and

Hydrocarbon containing formations (e.g., coal formations) may contain two or more layers of hydrocarbons. Hydrocarbon layers may be coal seams. Hydrocarbon layers may be separated by layers of material containing little or no producible hydrocarbons. The separating layers may function as natural barriers between hydrocarbon layers. Barriers may be formed adjacent to or in one or more of the hydrocarbon layers to define treatment areas. Barriers in different hydrocarbon layers may be formed at one time or at different times, as desired. Barriers may isolate one hydrocarbon layer from the rest of the formation, including other hydrocarbon layers. (page 67, lines 1-8).

Eastlund does not, for example, teach or suggest the combination of features that includes a heater well extending from a surface of the earth through an overburden of the formation and into a hydrocarbon containing layer and **transferring heat to the hydrocarbon containing layer** to at least mobilize hydrocarbons in the layer.

Eastlund appears to teach or suggest heating primarily within the wellbore. As shown in FIG. 1 and FIG. 7A of Eastlund, fluid production is through perforations 12 or 113, which are located in the hydrocarbon containing layer of the formation. No portion of the heater, however, is shown to be near the perforations and thus near or in the hydrocarbon containing layer. In fact, the bottom of the heater (shown by contactors 18 in FIG. 1 and sinker bar 115 in FIG. 7A) is shown to be distantly separated from the perforations in view of the "break lines" shown in FIG. 1 and FIG. 7A.

The distant separation of the heaters from the hydrocarbon containing layers in Eastlund is understandable in view of the fact that the Eastlund was only trying to heat fluids **in upper portions of the well**, as opposed the hydrocarbon containing layer itself. Eastlund states that "Normally, more heat is needed at the upper level of a well." (Eastlund, column 9, lines 62-63). More heat is needed in the upper level of the well because fluids cool as thy rise inside the well to the surface (the lower portion of a well is generally hotter than the upper portion of a well since the earth's temperature increases as depth increases). Thus Eastlund does not provide heat to the lower portions of the well that are closer to the hydrocarbon containing layer, where solids formation are much less likely to occur (since the lower portions of the well are deeper and hence hotter).

Stated another way, in Eastlund the fluids in the hydrocarbon containing layer are indicated as being already mobilized since Eastlund indicates that such fluids flow through the perforations and into the wellbore. These fluids are not heated in Eastlund until they need to be. That is, such fluids are not heated until they have risen to a sufficient level in the wellbore such that they are cooled (which will occur at upper levels of the wellbore that are closer to the earth's surface). This distance is enough that Eastlund specifically indicated that the heating is distantly separate from the perforations (this distant separation is shown with the "break lines" in the Eastlund FIG. 1 and FIG 7A). Thus, Eastlund does not teach or suggest transferring heat to a hydrocarbon containing layer of the formation and using that heat to mobilize hydrocarbons in the hydrocarbon containing layer.

Similarly, Rose does not appear to teach or suggest the combinations of features in claims 1691, 1711, and 1731 because Rose refers only to heating fluids inside of the device and Rose does not even mention wells or hydrocarbon containing formations. Specifically, Rose states: "It should be noted that the insulating layer 29 of Fig. 3 has been eliminated to provide a gap between return conductor 27 and ferromagnetic layer 31. This gap insulates such members from one another and may be employed to heat fluids; air, gas, water, or other liquid, for a variety of purposes. Any one of the insulating layers may be removed to accept fluid and in fact, three different fluids may be heated simultaneously to three different temperatures." (Rose, page 17, lines 18-26). Thus, Rose does not appear to teach or suggest transferring heat to a hydrocarbon containing layer of the formation and using that heat to mobilize hydrocarbons in the

hydrocarbon containing layer, as described in claims 1691, 1711, and 1731.

In addition, Applicant submits that Eastlund appears to teach away from operating at higher temperatures (for example, at or near the Curie temperatures described by Rose). Eastlund states: "It is believed that the maximum current flows primarily along the **inner** wall and decreases radially outward from the inner wall of the tubing with very little current flowing along the outer wall of the tubing. For this reason, shorting between the tubing and casing does not significantly affect the heating of the tubing by the current flowing therethrough and of course heat transfer through the liquid medium from the sucker rod." (Eastlund, column 7, lines 23-31, emphasis added). Eastlund also states: "In a test utilizing the system of FIG. 6 the casing and tubing were in electrical contact and shorted at 575 feet and 2,050 feet. The wire extended down in the well to a depth of 800 feet where the wire was shorted to the tubing by a scratcher. Fifty feet of free wire was connected to a source of power delivering 2140 watts from a 120 volt source. Power was controlled by an S.C.R. power controller. After 12.5 hours temperature at 350 feet had increased from 77.degree. F. to 89.degree. F. and at 750 feet had increased from 80.degree. F. to 90.degree. F. This test demonstrated that shorting between the tubing and casing does not substantially reduce the efficiency of the system of FIG. 6." (Eastlund, column 9, lines 21-33).

If, however, the Eastlund device were to operate at the Curie temperature, as taught by the Rose device, electrical current would flow through the entirety of the heater at the Curie temperature and significant current would flow along the **outer** wall of the tubing of the Eastlund device. Having significant electrical current flow on the tubing outer wall, along with shorting between the tubing and the casing, would significantly affect the heating of the tubing. Electrical current would flow between the tubing and casing due to the shorting if the heater were to operate at or near the Curie temperature. Thus, Eastlund teaches away from having electrical current flowing through the entire heater, as occurs at the Curie temperatures described by Rose. Thus modifying the Eastlund device to operate at the Curie temperatures described by Rose would appear to make the Eastlund device unsatisfactory for its intended purpose as disclosed by the above-quoted requirements for the Eastlund device.

In addition, Eastlund states: "An object of this invention is to electrically heat the tubing of a petroleum well by passing current through the tubing to **prevent formation of solids** such as

paraffins." (Eastlund, column 1, lines 47-50) (emphasis added). Modifying the Eastlund device to operate at or near the Curie temperatures described by Rose would appear to render the Eastlund device unsatisfactory for its intended purpose of preventing formation of solids. In fact, operating the Eastlund device at or near the Curie temperatures (which are generally much higher than the temperatures contemplated by Eastlund) may **increase the formation of solids** by increasing the cracking of hydrocarbons (petroleum) inside the tubing, thus leading to coke (solid carbon) formation in the tubing. Thus, Eastlund appears to teach away from operating at or near the Curie temperatures as described by Rose.

For the above reasons, Applicant respectfully requests withdrawal of the obviousness rejection of claims 1691, 1711, 1731, and the claims dependent thereon.

Applicant submits, in addition, that some of the claims dependent on claims 1691, 1711, and 1731 are separately patentable.

Claims 1692 and 1712 describe combinations of features including: "at least one production well extending into the hydrocarbon containing layer and configured to produce at least some of the mobilized hydrocarbons from the hydrocarbon containing layer." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1692 and 1712, in combination with the other features of the claims.

Claims 1693 and 1713 describe combinations of features including: "wherein at least one electrical conductor transfers heat during use to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1693 and 1713, in combination with the other features of the claims.

Claims 1694 and 1714 describe combinations of features including: "wherein at least one electrical conductor transfers heat during use to hydrocarbons in the hydrocarbon containing layer to pyrolyze at least some hydrocarbons in the layer." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1694 and 1714, in combination with the other features of the claims.

Claims 1695 and 1715 describe combinations of features including: "wherein at least one of the ferromagnetic sections heats during use to a temperature of at least about 650 °C." The

cited art does not appear to teach or suggest at least the above-quoted features of claims 1695 and 1715, in combination with the other features of the claims.

Claims 1696 and 1716 describe combinations of features including: "wherein the AC supply is configured to provide AC at a voltage below about 2500 volts." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1696 and 1716, in combination with the other features of the claims.

Claims 1697 and 1717 describe combinations of features including: "wherein the heater well extends from the surface of the earth through an overburden of the formation into the hydrocarbon containing layer." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1697 and 1717, in combination with the other features of the claims.

Claims 1699 and 1719 describe combinations of features including: "wherein at least one of the ferromagnetic sections comprises iron, nickel, chromium, cobalt, tungsten, or a mixture thereof." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1699 and 1719, in combination with the other features of the claims.

Claims 1700 and 1720 describe combinations of features including: "wherein at least one of the ferromagnetic sections has a thickness of at least about ¾ of a skin depth of the AC at the Curie temperature of such ferromagnetic sections." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1700 and 1720, in combination with the other features of the claims.

Claims 1701 and 1721 describe combinations of features including: "wherein the heat output below the selected temperature is greater than about 400 watts per meter of electrical conductor." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1701 and 1721, in combination with the other features of the claims.

Claims 1702 and 1722 describe combinations of features including: "wherein at least a portion of the electrical conductor is longer than about 10 m." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1702 and 1722, in combination with the other features of the claims.

Claims 1703 and 1723 describe combinations of features including: "wherein one or more of the ferromagnetic sections are configured to sharply reduce the heat output at or near the

selected temperature." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1703 and 1723, in combination with the other features of the claims.

Claims 1704 and 1724 describe combinations of features including: "wherein the heat output from at least a portion of the ferromagnetic sections decreases at or near the selected temperature due to the Curie effect." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1704 and 1724, in combination with the other features of the claims.

Claims 1705 and 1725 describe combinations of features including: "wherein the AC resistance of the electrical conductor increases with an increase in temperature up to the selected temperature, and wherein the AC resistance of the electrical conductor decreases with an increase in temperature above the selected temperature." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1705 and 1725, in combination with the other features of the claims.

Claims 1706 and 1726 describe combinations of features including: "wherein the AC supply provides an electrical current of at least about 70 amps to the electrical conductor." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1706 and 1726, in combination with the other features of the claims.

Claims 1707 and 1727 describe combinations of features including: "wherein at least one of the electrical conductors comprises a turndown ratio of at least about 2 to 1." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1707 and 1727, in combination with the other features of the claims.

Claims 1708 and 1728 describe combinations of features including: "wherein the AC supply applies AC at about 180 Hz." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1708 and 1728, in combination with the other features of the claims.

Claims 1709 and 1729 describe combinations of features including: "wherein the system withstands operating temperatures of about 250 °C or above." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1709 and 1729, in combination with the other features of the claims.

Claims 1710 and 1730 describe combinations of features including: "wherein the

electrical conductor automatically provides the reduced amount of heat above or near the selected temperature." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1710 and 1730, in combination with the other features of the claims.

Claim 1732 describes a combination of features including: "producing at least some of the mobilized hydrocarbons from the layer through a production well extending into the hydrocarbon containing layer." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1732, in combination with the other features of the claim.

Claim 1733 describes a combination of features including: "wherein the transferred heat pyrolyzes at least some hydrocarbons in the hydrocarbon containing layer." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1733, in combination with the other features of the claim.

Claim 1734 describes a combination of features including: "producing at least some of the pyrolyzed hydrocarbons from the layer through a production well extending into the hydrocarbon containing layer." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1734, in combination with the other features of the claim.

Claim 1735 describes a combination of features including: "wherein the heater well extends from the surface of the earth through an overburden of the formation into the hydrocarbon containing layer." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1735, in combination with the other features of the claim.

Claim 1736 describes a combination of features including: "wherein at least one of the ferromagnetic sections heats to a temperature of at least about 650 °C." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1736, in combination with the other features of the claim.

Claim 1737 describes a combination of features including: "providing the AC at a voltage below about 2500 volts." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1737, in combination with the other features of the claim.

Claim 1738 describes a combination of features including: "providing the AC to at least one of the electrical conductors at or above the selected temperature." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1738, in combination with the other features of the claim.

Claim 1739 describes a combination of features including: "providing the AC at a frequency of about 180 Hz." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1739, in combination with the other features of the claim.

Claim 1740 describes a combination of features including: "providing an initial electrically resistive heat output when the electrical conductor providing the heat output is at least about 50 °C below the selected temperature, and automatically providing the reduced amount of heat above or near the selected temperature." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1740, in combination with the other features of the claim.

Claim 1741 describes a combination of features including: "wherein an AC resistance of at least one of the ferromagnetic sections decreases above the selected temperature to provide the reduced amount of heat." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1741, in combination with the other features of the claim.

Claim 1742 describes a combination of features including: "wherein at least one of the ferromagnetic sections has a thickness of at least about ¾ of a skin depth of AC at the Curie temperature of the ferromagnetic material." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1742, in combination with the other features of the claim.

Claim 1743 describes a combination of features including: "wherein the reduced amount of heat is less than about 400 watts per meter of length of electrical conductor." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1743, in combination with the other features of the claim.

Claim 1744 describes a combination of features including: "controlling a skin depth in at least one of the ferromagnetic sections by controlling a frequency of the applied AC." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1744, in combination with the other features of the claim.

Claim 1745 describes a combination of features including: "applying additional current to at least one of the ferromagnetic sections as the temperature of such ferromagnetic sections increases until the temperature is at or near the selected temperature." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1745, in combination with

the other features of the claim.

Claim 1746 describes a combination of features including: "controlling an amount of heat provided by at least one of the ferromagnetic sections by controlling an amount of current applied to at least one of the electrical conductors." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1746, in combination with the other features of the claim.

Claim 1747 describes a combination of features including: "applying current of at least about 70 amps to at least one of the electrical conductors." The cited art does not appear to teach or suggest at least the above-quoted features of claim 1747, in combination with the other features of the claim.

D. The Claims Are Not Obvious Over Eastlund et al. In View of Rose And Further In View of Bridges et al. Pursuant To 35 U.S.C. §103(a)

Claims 1698 and 1718 were rejected under 35 U.S.C. §103(a) as being unpatentable over Eastlund in view of Rose and further in view of Canadian Patent No. 2,151,521 to Bridges et al. Applicant respectfully disagrees with this rejection.

Claims 1698 and 1718 describe combinations of features including: "wherein the system comprises three or more electrical conductors, and wherein at least three of the electrical conductors are coupled in a three-phase electrical configuration." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1698 and 1718, in combination with the other features of the claims.

For at least the reasons cited above in Section C of this document, Eastlund and Rose do not appear to teach, suggest, or provide motivation for the above-quoted features of the claims.

D. Provisional Double Patenting Rejections

Claims 1691-1747 were provisionally rejected under the judicially created doctrine of

obviousness-type double patenting as being unpatentable over claims 1691-1743 of copending U.S. Pat. Appl. No. 10/693,700 or claims 1691-1753 of copending U.S. Pat. Appl. No. 10/693,840. Upon the present application being in condition for allowance but for the double patenting rejections, Applicant will provide arguments for the inappropriateness of the double patenting rejections and/or provide a terminal disclaimer.

E. New Claims

Claims 1748, 1750, and 1752 describe combinations of features including: "wherein the heater well extends at least about 10 m into the hydrocarbon containing layer." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1748, 1750, and 1752, in combination with the other features of the claims.

Claims 1749, 1751, and 1753 describe combinations of features including: "wherein the hydrocarbon containing layer comprises hydrocarbons configured to be treated and produced from the formation using an in situ conversion process." The cited art does not appear to teach or suggest at least the above-quoted features of claims 1749, 1751, and 1753, in combination with the other features of the claims.

F. Additional Comments

An authorization to deduct the fee for the new claims from a deposit account will be submitted upon the filing of the document. If any extension of time is required, Applicant hereby requests the appropriate extension of time. If any additional fees are required or any fees have been overpaid, please charge or credit those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5659-20900/EBM.

Respectfully submitted,

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